Vacuum Solutions | Application Support | Service

LEYBOLD

LEYBOLD VACUUM USA INC.
Cryogenics North America

Manual Number 800 007 BE
Revision D
May 16, 2001

Coolpower

Models 4.2GM, 445, 130, 065 and 150

Catalog No. 011 864 –T
Catalog No. 011 826 –T
Catalog No. 011 702 –T
Catalog No. 011 085 –T
Catalog No. 011 704 –T

Over 150 Years

Cold Head Operating Instructions

Carefully read these operating instructions before unpacking and connecting equipment.

Table of Contents

Table of Figures

SAFETY AND PRECAUTIONS

The Leybold Cryocooler system is a high pressure, high voltage device that must be installed, operated and maintained with appropriate caution. Standard safety measures and techniques should be observed.

While these components have been designed in accordance with industry safety standards, equipment damage, injury, or death may occur if proper precautions are not followed carefully.

The following precautions must be observed when working with this equipment.

- **Read the instructions for unpacking the unit and follow the prescribed procedures carefully.** Carefully following the instructions can prevent accidental damage to the unit.

- **Do not tilt the compressor in any direction during any operation**, under any circumstances. Oil may contaminate the system resulting in malfunction or damage.

- **Operate the compressor only** after ensuring that all water and electrical connections have been made properly. Check that all utilities are verified to be within the specified requirements and that the compressor is phased properly.

- **Always use two wrenches** when connecting and disconnecting self-sealing couplings to prevent loosening of the fixed fitting. (Otherwise this would vent high pressure, high purity helium from the system, causing a malfunction.)

- **Turn off and lock out the power source** whenever maintenance is performed.

- **Electrical work must be performed by properly trained personnel.**

Damaged units should be returned to the factory with a Return Material Authorization (RMA) number. Please call Customer Service at:

LEYBOLD SERVICE DEPARTMENT
18 CELINA AVENUE
NASHUA, NH 03063
603-595-2400

- Do not disassemble any part of a component without releasing the gas from all portions of the component unless specifically recommended by the operating instructions. For example, the compressor may remain charged during the replacement of the adsorber. (See the Operating Instructions for the Leybold 6000 MD, 6200 MD or UCC 110S Compressor for additional information about this topic).

- Never disable or otherwise alter any relief valve on any component. If it is suspected that any relief or bypass valve is malfunctioning, contact Leybold to arrange a return of the system for evaluation and correction.

- Do not exceed the maximum static charge pressure of 232 psig (1600 kPa, 16 Bar) of any component within the 6000 MD or 6200 MD compressors. Do not exceed the maximum static charge pressure of 250 psig (1724 kPa, 17.2 Bar) of any component within the UCC 110S compressor.

- The pressure values are always given in 'gauge' readings, not in "absolute" pressure (For example, `psig' means Pounds Per Square Inch, Gauge and 'kPa' means Kilo Pascals, gauge).

- Always use helium with guaranteed purity of 99.999% and water dew point of less than -80 °F (-62 °C).

- Never attempt to add high pressure helium to any component of the refrigeration system without the use of an appropriate pressure regulator and an appropriate gas transfer line.

- Adequate ventilation must be provided when venting, purging or charging any component with helium.

- Make sure that the unit is free from poisonous substances before returning it to Leybold for maintenance or repair. **PRODUCTS EXPOSED TO RADIOACTIVE MATERIAL CANNOT BE ACCEPTED BY LEYBOLD UNDER ANY CIRCUMSTANCES.** A Customer Service Contamination Data Fact Sheet is included at the end of this manual. It must be supplied in accordance with the instructions stated on the sheet for all returns.

1.0 UNPACKING

1.1 INSPECTION

Before unpacking the cold head examine the carton for any discrepancies or damage. In the case of any discrepancies or damage, take a photograph of the shipping carton and the unit and write a description of the problem. This information will be needed in order for you to file a claim with your shipping carrier. The claim must be filed within 7 days of receipt of the unit.

1.2 PARTS LIST

The following items will be found in the shipping carton.

- Operating Manual
- Cold Head

1.3 UNPACKING PROCEDURE

READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE UNPACKING THIS UNIT:

1. Open the carton containing the Cold Head.
2. Remove the top half of the foam packing. Carefully remove the cold head. Be careful not to drop or strike the cold head against any surface. Take extreme caution to avoid denting or bending the cold head cylinders during handling.

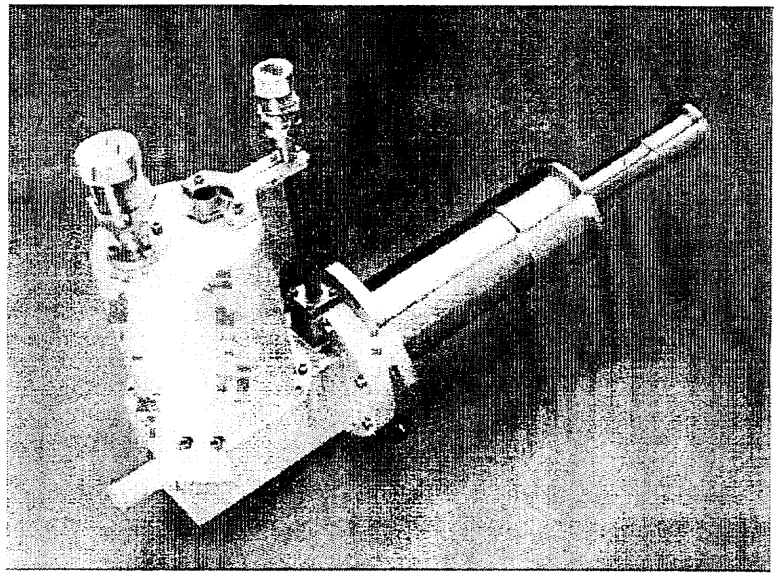


FIGURE 1.1 COOLPOWER 2 STAGE COLD HEAD

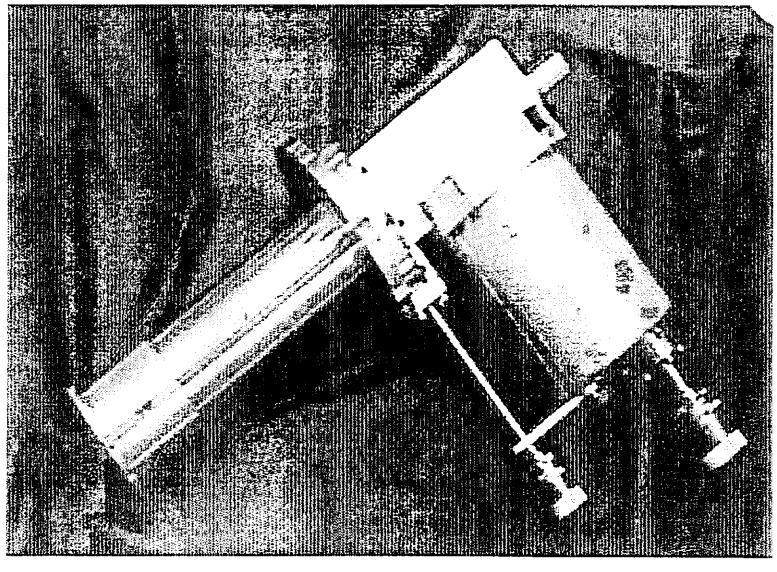


FIGURE 1.2 COOLPOWER SINGLE STAGE COLD HEAD

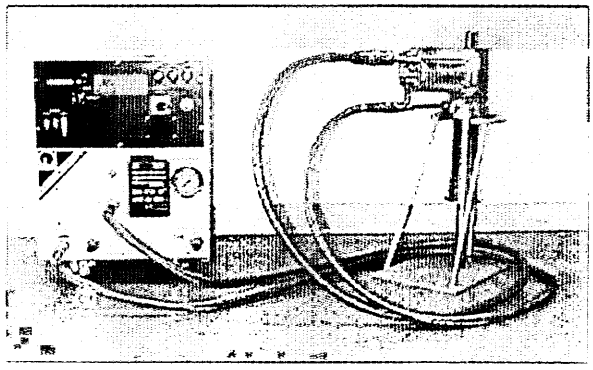
CAUTION!

BE CAREFUL NOT TO DROP THE COLD HEAD OR STRIKE IT AGAINST ANY SURFACE. EVEN THE SLIGHTEST DENT OR BEND IN THE COLD HEAD CYLINDER WILL SERIOUSLY DAMAGE THE UNIT.

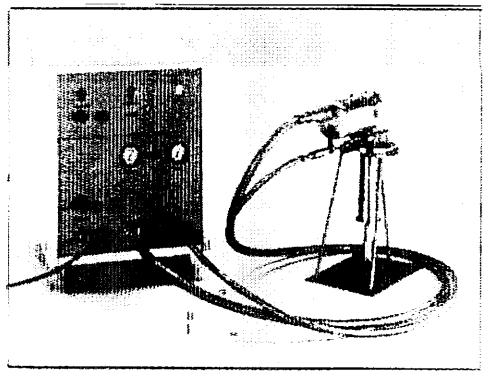
2.0 SYSTEM DESCRIPTION

The typical system as shown in Figure 2.1 consists of the following components:

- Compressor
- Cold Head
- Connection lines for gas (supply and return), power cable and remote control cable (where applicable).



Cold Head with a 6200MD Compressor



Cold Head with a UCC110S Compressor

FIGURE 2.1 TYPICAL SYSTEM - HELIUM COMPRESSOR AND COLD HEAD

The compressor delivers clean, compressed **helium gas** at room temperature to the cold head. It also supplies power and controls for the whole refrigerator system, including the cold head.

The gas lines act as supply and return hoses, allowing helium to flow between the compressor and the cold head. The electrical cables are used for system power, the cold head motor and remote control (where applicable).

Refer to the Compressor Manual for additional information.

The description, application and operation of the Cold Head is explained in detail in the following section.

3.0 COLD HEAD DESCRIPTIONS

Model	Description	1st Stage Temp.	2nd Stage Temp.	Bottom Temp.
4.2GM	2 Stage, Closed Cycle	45W @ 50K Max.	.5 W @ 4.2K Max.	35K - 1st Stage 3.7K - 2nd Stage
445	2 Stage, Closed Cycle	45W @ 45K Max.	7W @ 10K Max.	6K - 2nd Stage
130	2 Stage, Closed Cycle	115W @ 77K Max.	15W @ 20K Max.	9K - 2nd Stage
065	2 Stage, Closed Cycle	65W @ 77K Max.	6W @ 20K Max.	13K - 2nd Stage
150	Single Stage Cycle	150W @ 77K Max.	-	28K -One Stage

Capacity- Loadmaps shown in Figures 3.6 through 3.9 are for tested models and represent expected nominal performance during operation.

Primary applications include:

- Cryopumps
- Cryostats for specimen cooling
- Target cooling for high energy physics
- Liquefaction of gases (including helium)
- Cooling infrared detectors
- Shield coolers for superconducting magnets
- Direct cooling of superconducting magnets

The expansion of the helium gas in the cold head results in refrigeration. Inside the cold head is a dual-diameter piston-like mechanism, a "displacer", which is driven by an electric motor. The displacer is made of low thermal conductivity material incorporating internal regenerators. It is connected to the drive rod by universal joints. Both stages of the displacer are fitted with replaceable seals.

The displacer moves up and down in the cold head cylinder. As it does, an inlet (high pressure) valve and exit (low pressure) valve open and close as shown in Figure 3.1. The valving is accomplished using a cylindrical slide valve made of high alumina ceramic. The valve is switched by the displacer motion and is restrained from additional movement by a spring-loaded friction ring.

The high pressure helium gas is fed into the refrigerator through the inlet valve on the crank case/valve body housing. The low pressure helium is exhausted from the refrigerator through the drive motor to provide additional cooling to the motor.

The net gain of refrigeration of each cycle must be sufficient to compensate for all the heat introduced by the refrigerator (compression, friction, etc.) as well as whatever external heat load is applied at the stations of the cylinders. The timing of the cycle, the efficiencies of the regenerator matrices, conductive and other heat losses must all be controlled to yield a net gain in cooling with each cycle until thermal equilibrium is attained.

The external load cannot exceed the net refrigeration of the system for any prolonged period of time, without a loss of cooling and resultant warm up.

Due to the thermal limitations of the regenerator matrix material of the first stage regenerator, a second stage regenerator of different material is required to provide useful refrigeration below 30K. The sizes and materials selected for these regenerators (in the Coolpower 4.2GM for example), can yield a working refrigeration capacity of 35K on the first stage, and 3.7K on the second stage.

REFRIGERATION CYCLE

C *Compressor*
A *Adsorber*
S *Oil Separator*
R *Regenerator*

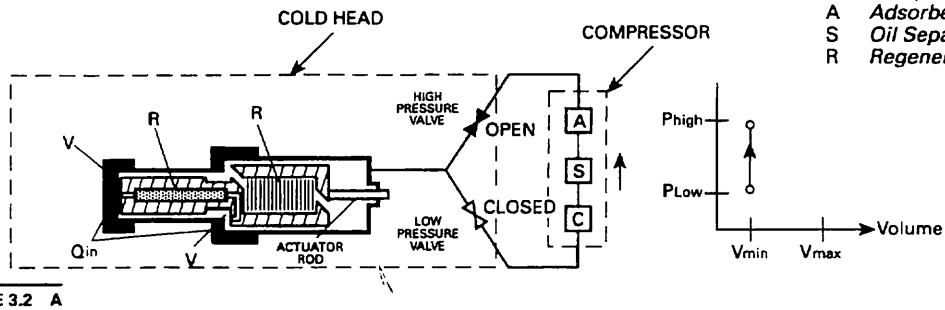


FIGURE 3.2 A

With the displacer at the top dead center position, the inlet valve is open and high pressure ambient temperature gas from the compressor flows into the warm volume and the regenerator matrices.

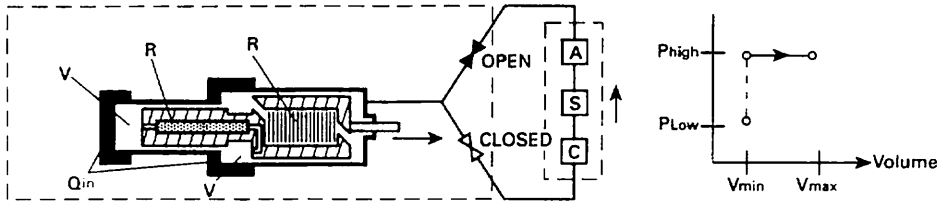


FIGURE 3.2 B

With the inlet valve still open, the displacers move from the top center to the bottom dead center position. The high pressure gas gives up heat as it flows through the cooler regenerator matrices and fills the cold volumes with cooled high pressure gas.

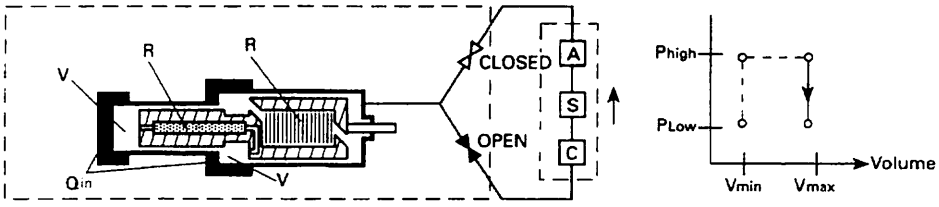


FIGURE 3.2 C

As the displacer reaches the bottom of its travel, the inlet valve closes and the outlet valve opens. As the outlet valve opens, the cooled high pressure gas expands and cools further. The expansion continues until the pressure within the cold head equalizes.

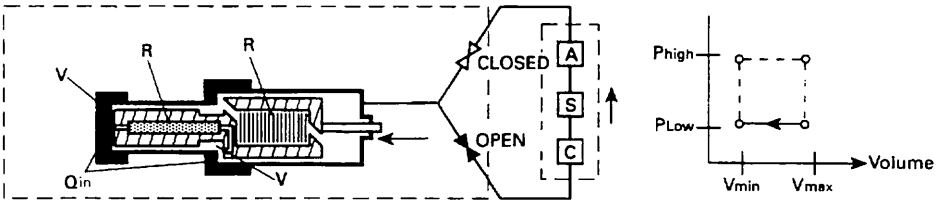
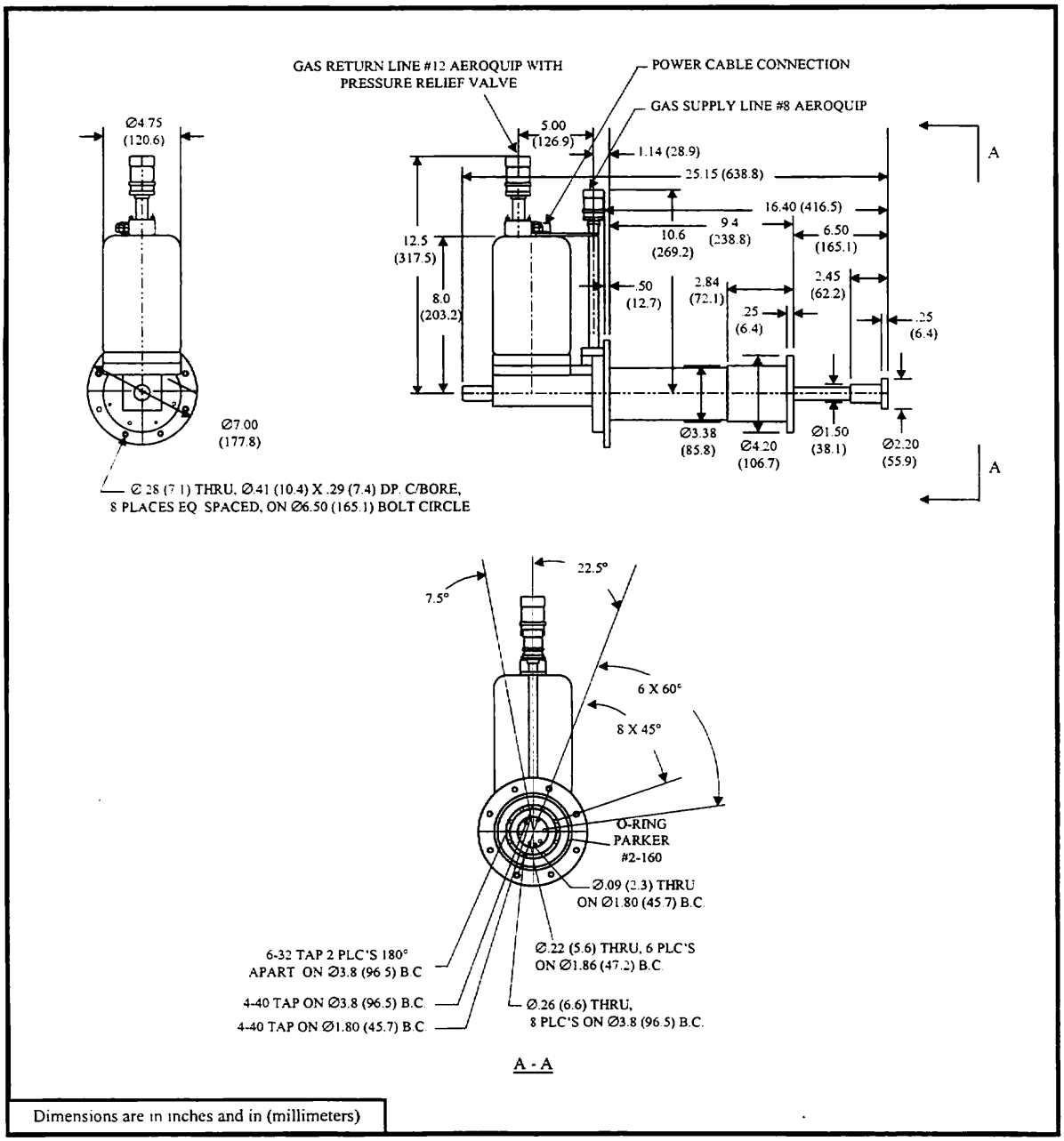


FIGURE 3.2 D

With the outlet valve still open, the displacer moves from the bottom dead center to the top dead center position. The cold low pressure gas accepts heat as it flows through and recools the regenerator matrices. When the displacer reaches top dead center the low pressure valve closes and the cycle is repeated.

FIGURE 3.1 REFRIGERATION CYCLE

FIGURE 3.2 OUTLINE DRAWING FOR THE COOLPOWER 4.2GM



Dimensions are in inches and in (millimeters)

FIGURE 3.3 OUTLINE DRAWING FOR THE COOLPOWER 445 & 130

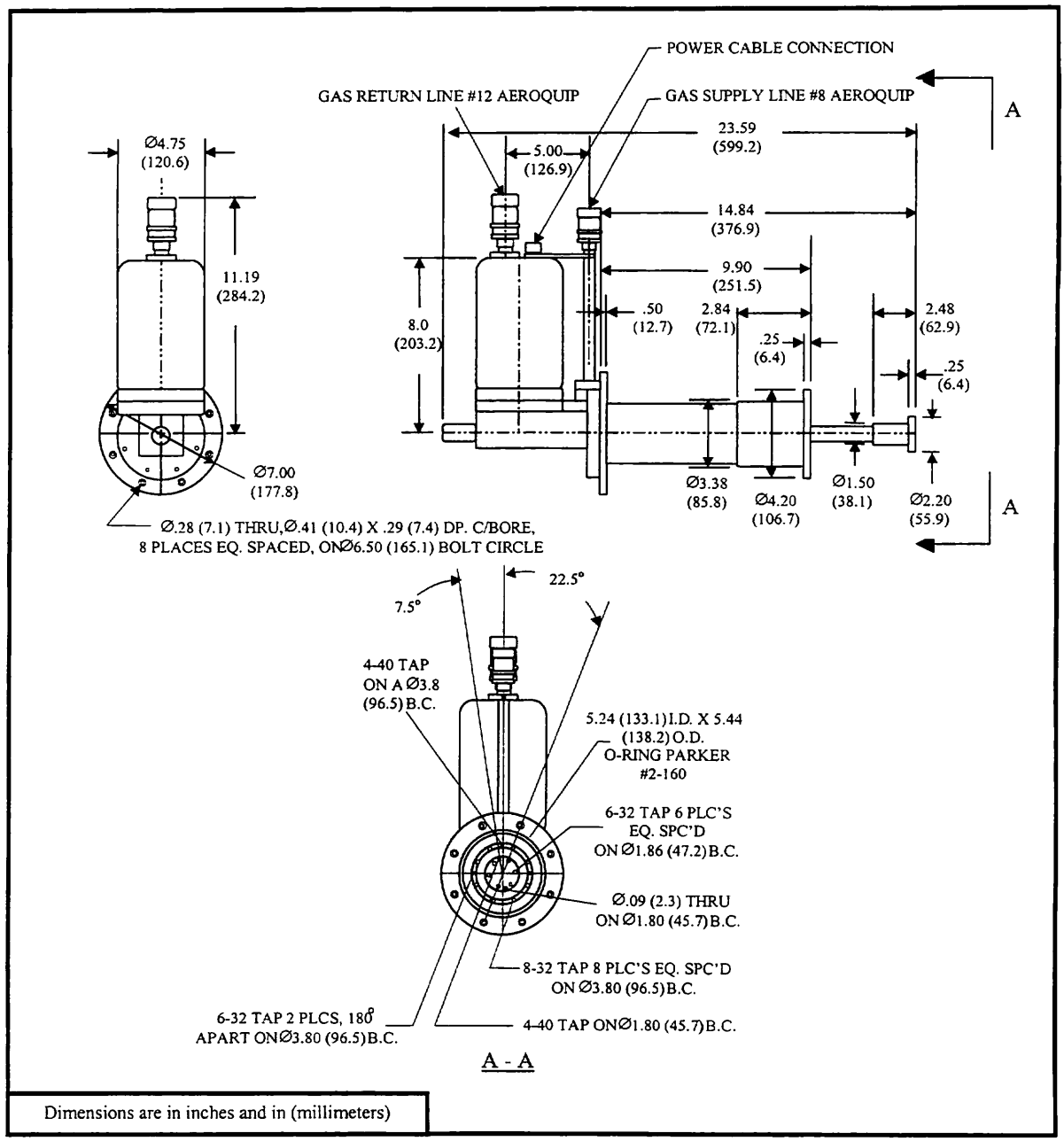


FIGURE 3.4 OUTLINE DRAWING FOR THE COOLPOWER 065

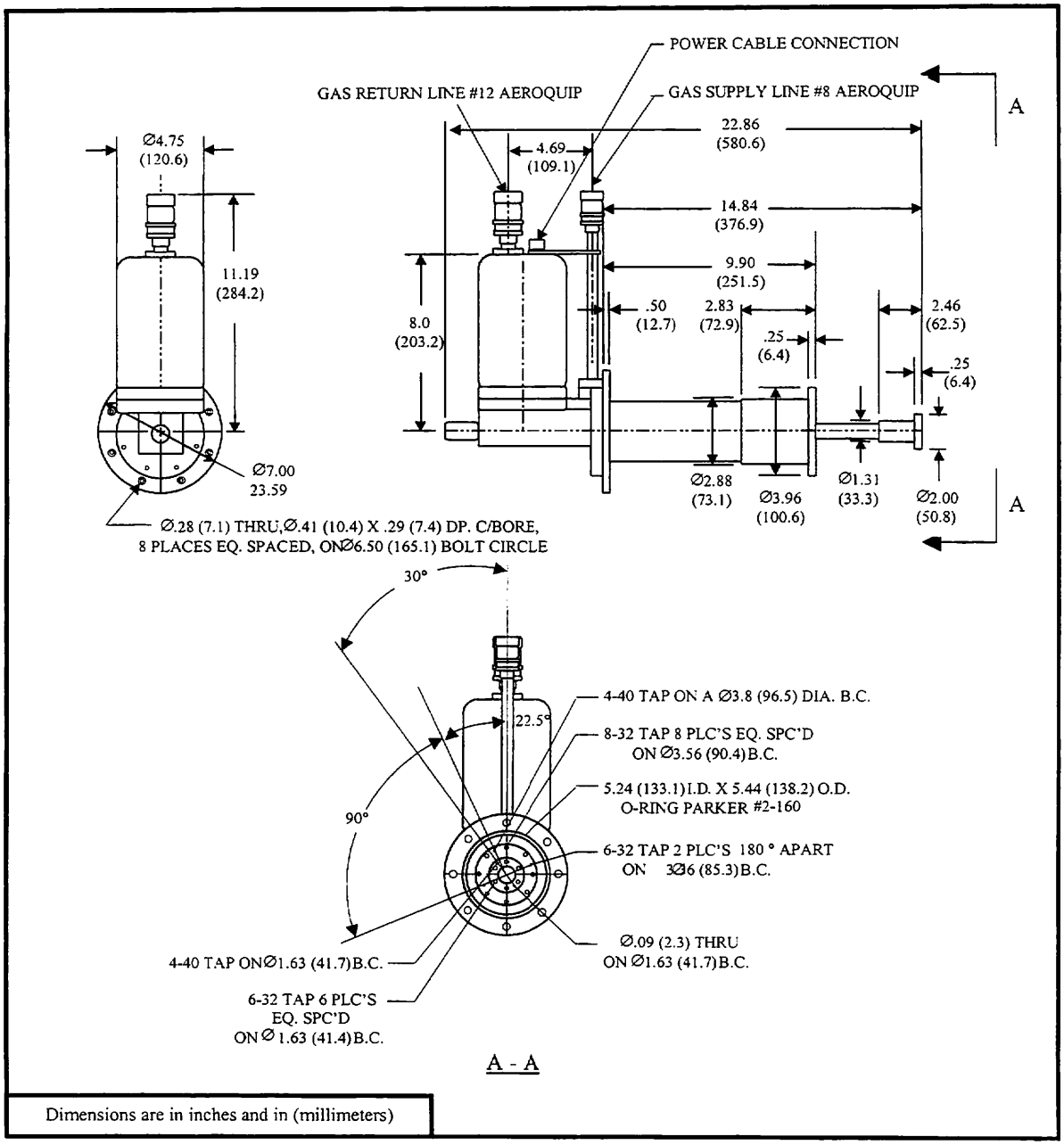
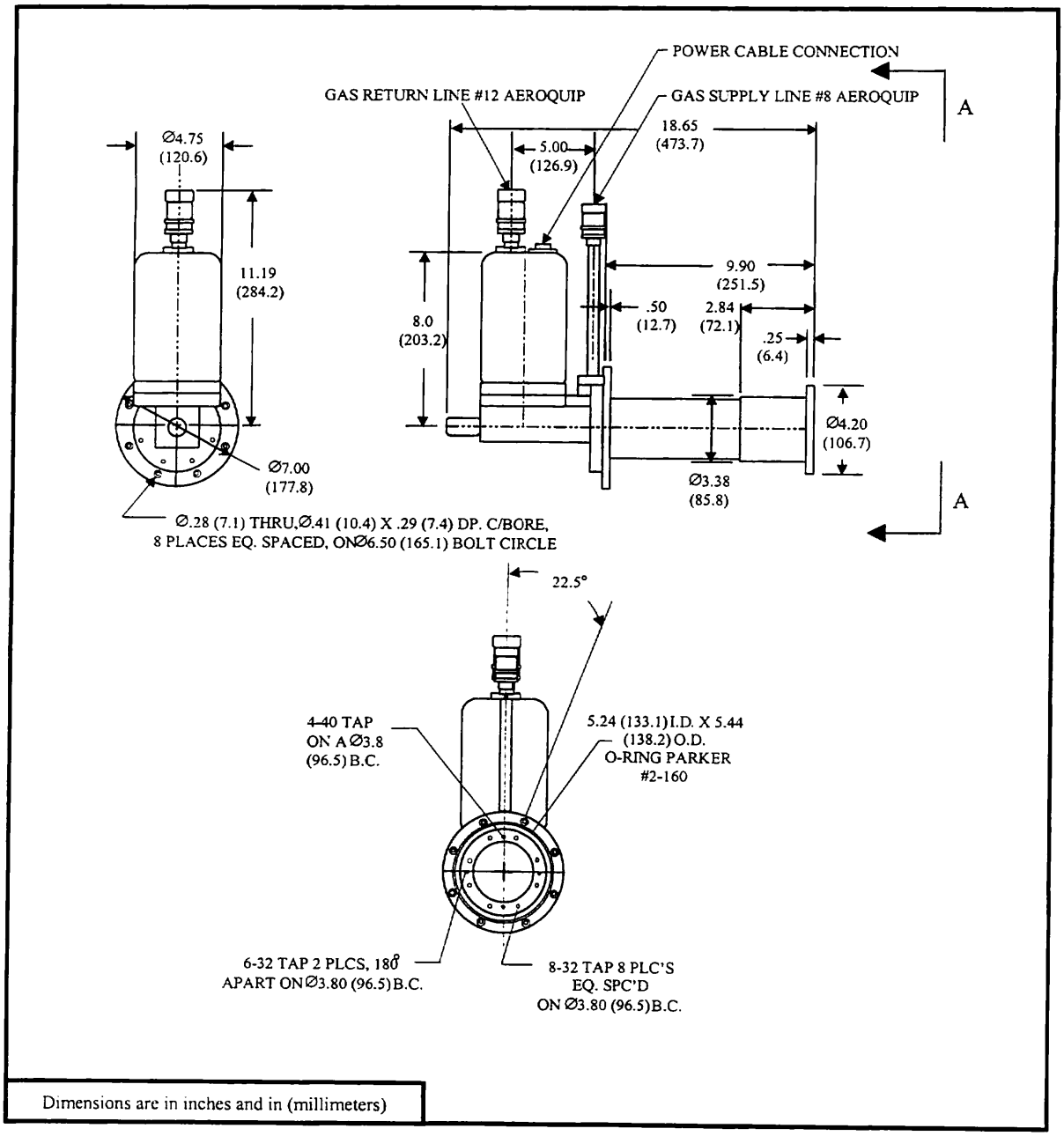


FIGURE 3.5 OUTLINE DRAWING FOR THE COOLPOWER 150



Dimensions are in inches and in (millimeters)

FIGURE 3.6 CAPACITY MAP FOR THE COOLPOWER 4.2GM

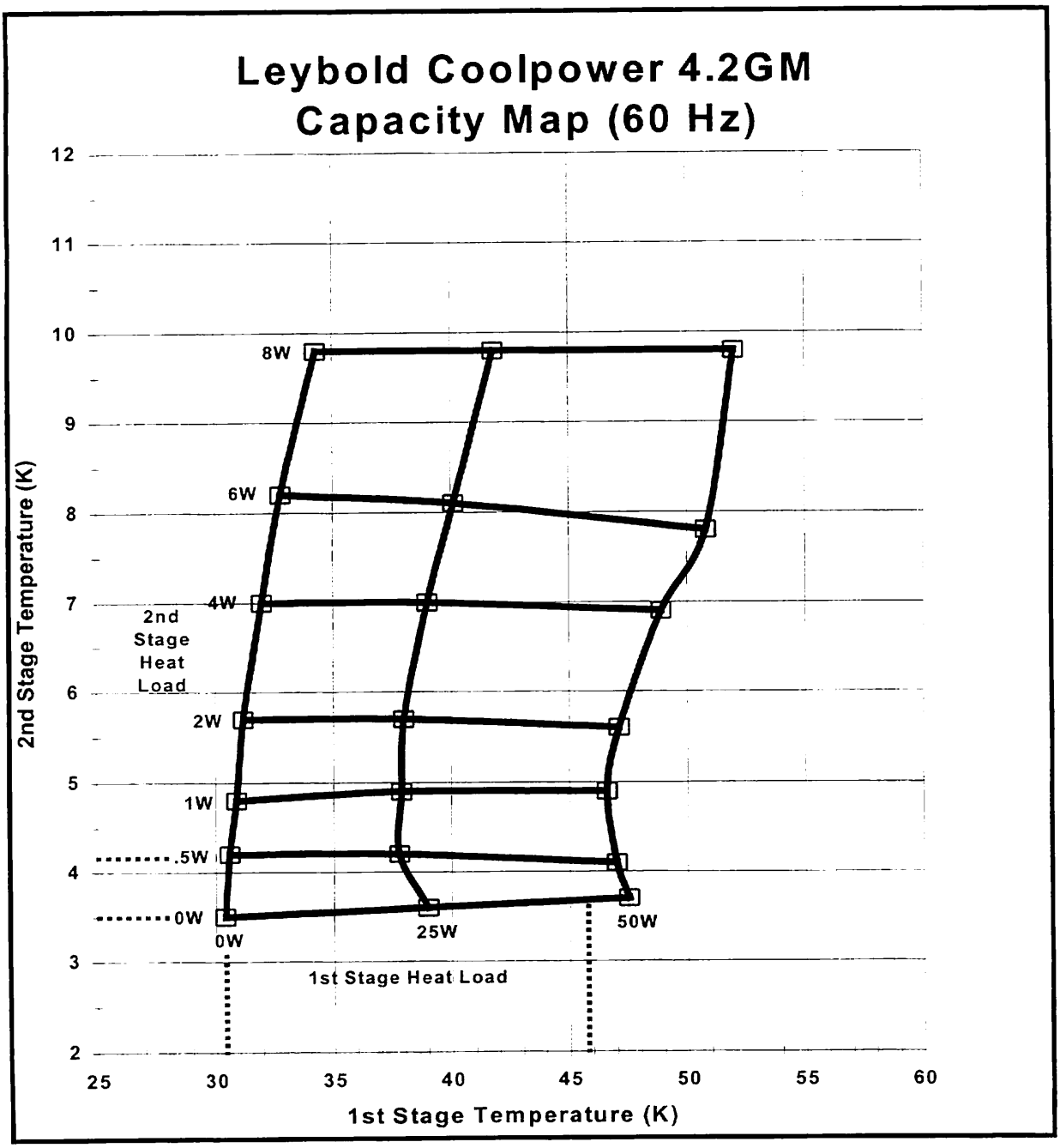


FIGURE 3.7 CAPACITY MAP FOR THE COOLPOWER 445

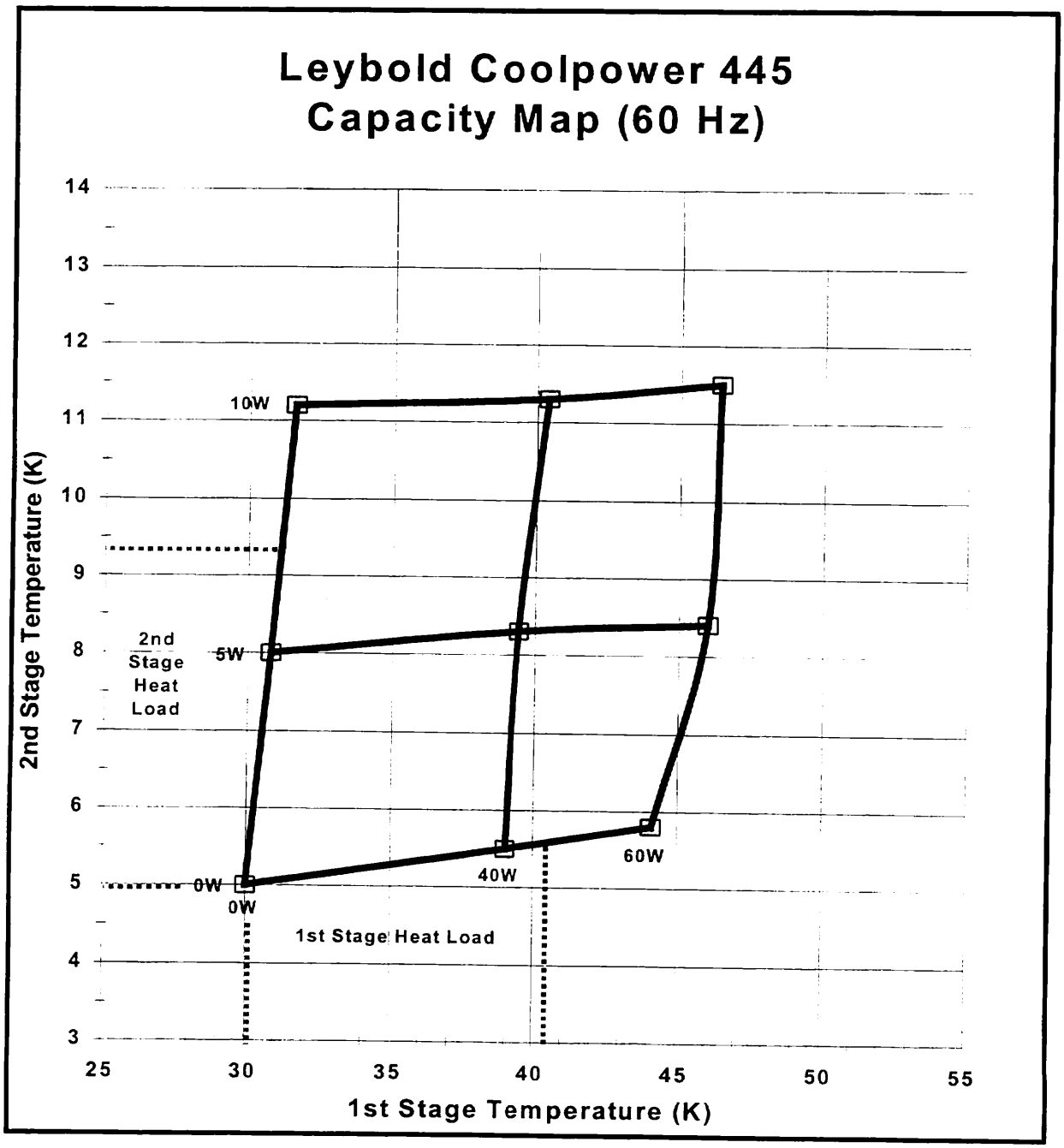


FIGURE 3.8 CAPACITY MAP FOR THE COOLPOWER 130

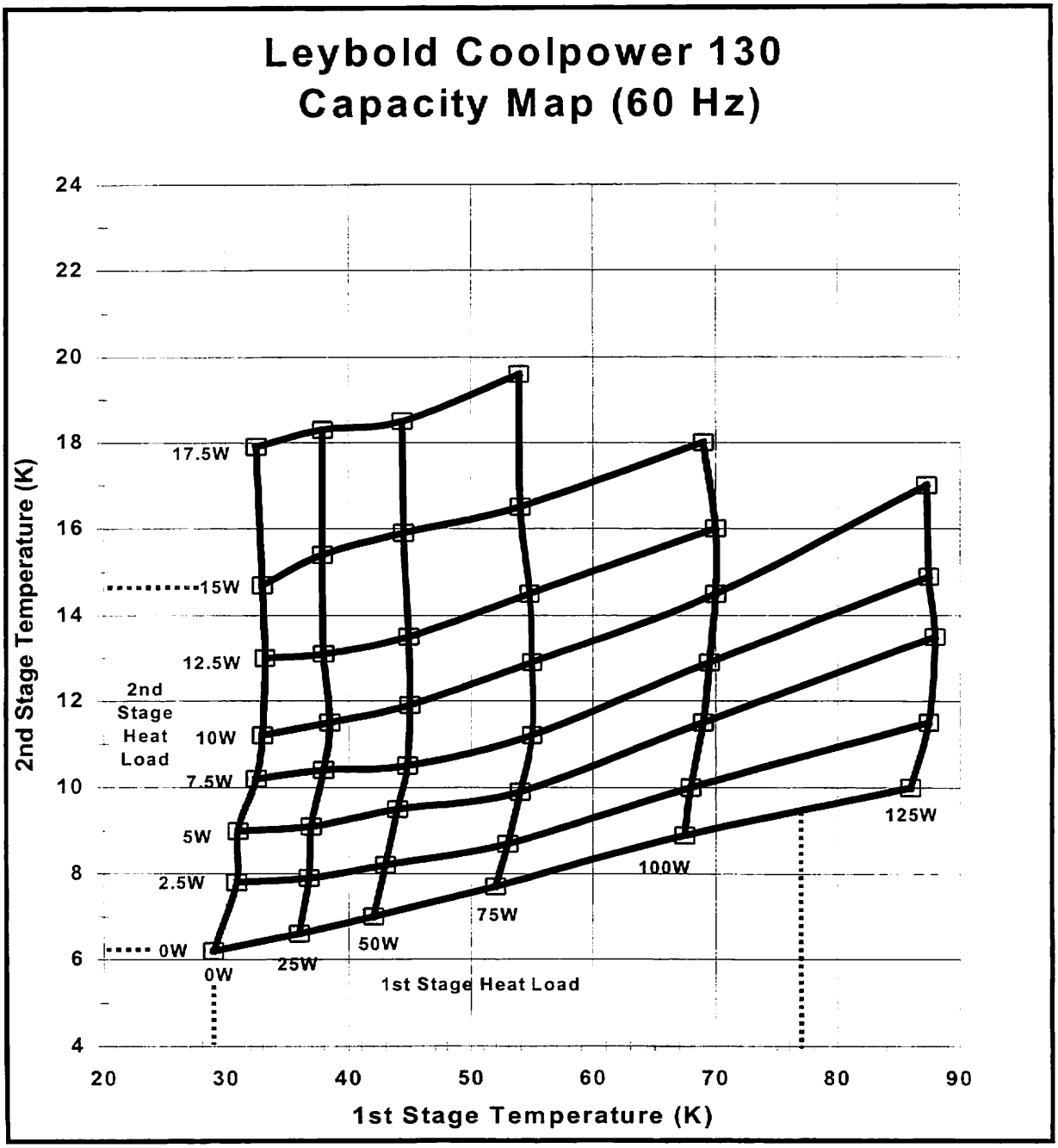


FIGURE 3.9 CAPACITY MAP FOR THE COOLPOWER 065

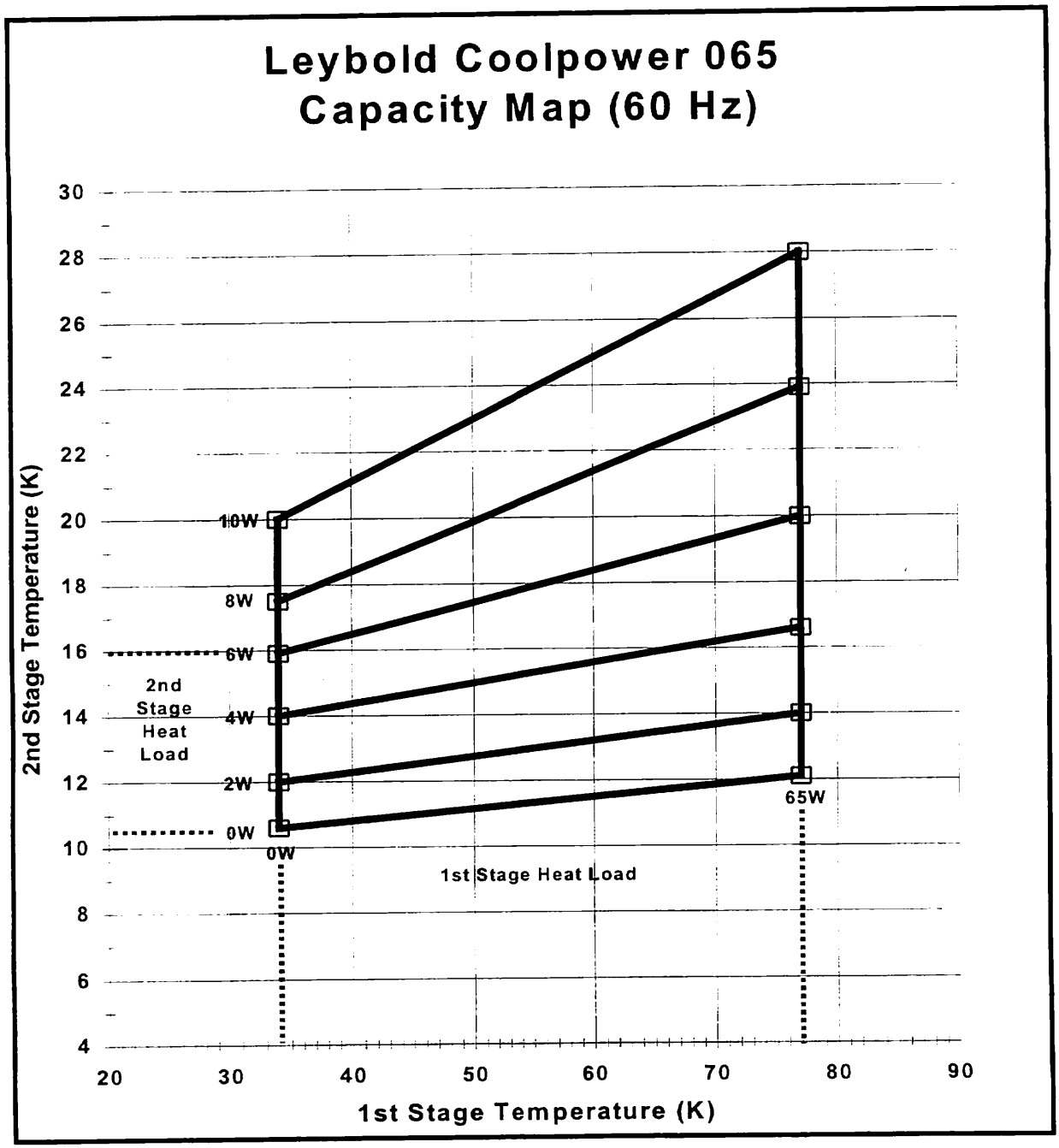
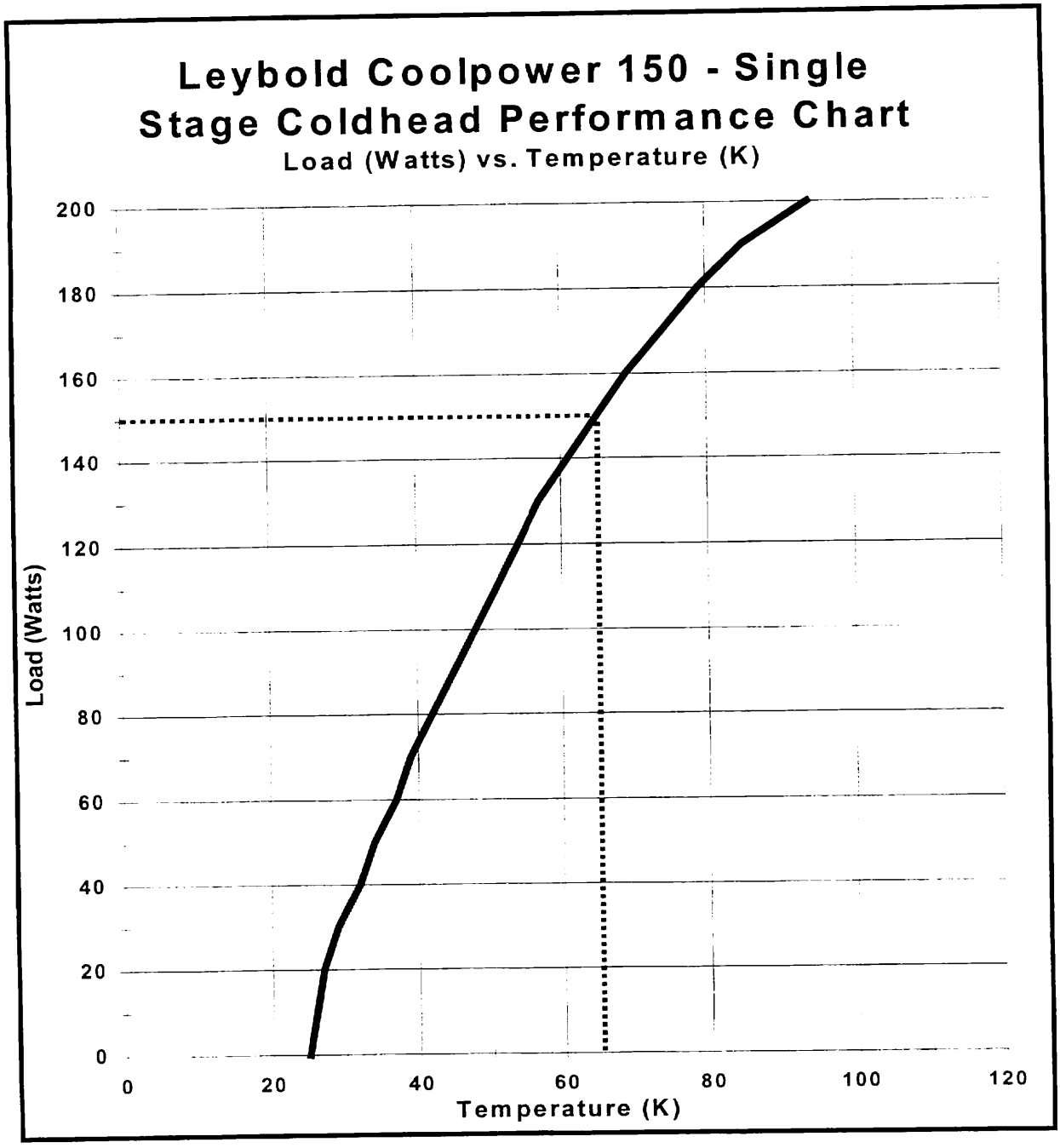


FIGURE 3.10 CAPACITY MAP FOR THE COOLPOWER 150



4.0 INSTALLATION AND CONNECTIONS

DO NOT ATTEMPT TO CONNECT OR OPERATE ANY COMPONENT OF THE CRYOGENIC REFRIGERATOR SYSTEM UNTIL THE APPLICABLE OPERATING INSRTRUCTIONS HAVE BEEN READ AND UNDERSTOOD IN THEIR ENTIRETY.

THE COOLPOWER CRYOGENIC REFRIGERATORS ARE UNDER HIGH PRESSURE. OBSERVE SAFETY TECHNIQUES AND PRACTICES THAT ARE APPROPRIATE FOR HIGH PRESSURE DEVICES.

WHILE THESE COMPONENTS HAVE BEEN DESIGNED WITH THE UTMOST CARE AND ATTENTION TO SAFE OPERATION, IMPROPER USE OR FAILURE TO FOLLOW RECOMMENDED PROCEDURES CAN RESULT IN DAMAGE TO THE EQUIPMENT OR PERSONAL INJURY.

SERVICE TO ANY COMPONENT OF THE SYSTEM MUST BE PERFORMED BY TRAINED AND QUALIFIED LEYBOLD SERVCE PERSONNEL. CONTACT LEYBOLD AT 603-595-2400 FOR TRAINING INFORMATION.

4.1 PREPARATION FOR USE

The refrigerator may be integrated as part of a cryogenic pump or installed in any appropriate vacuum vessel for use or testing. The external surfaces of the refrigerator that will extend into the vacuum space should be cleaned in accordance with standard vacuum practices. Care must be taken that all o-rings, which provide the vacuum seal, are properly cleaned and installed.

4.2 CONNECTING AND DISCONNECTING THE GAS FLEXLINES

Each Leybold Cryogenic Refrigerator is shipped with a proper charge of helium. It may be directly connected to a charged Leybold compressor using one supply flexline and one return flexline. Flexlines are regularly supplied as part of a Leybold refrigerator system and are also precharged with helium. The flexlines for the compressor and cold head are connected via self-sealing couplings so the connections can be made at system pressure.

FOR SYSTEMS USING THE 6000 MD OR 6200 MD COMPRESSOR:

- When the system is properly connected, the pressure displayed on the compressor's pressure gauge should read between 189-232 psig (1303-1600 kPa, 13.0-16.0 Bar). If the pressure is less than 189 psig (1303 kPa, 13.0 Bar), it is possible that one of the components was damaged in shipment and is losing its gas charge. This can cause system contamination. Contact Leybold's Service Department for assistance.

FOR SYSTEMS USING UCC 110S COMPRESSOR:

- When the system is properly connected, the pressure displayed on the compressor's pressure gauge should read between 245-250 psig (1600-1724 kPa, 16.9-17.2 Bar). If the pressure is less than 245 psig (1690 kPa, 16.9 Bar), it is possible that one of the components was damaged in shipment and is losing its gas charge. This can cause system contamination. Contact Leybold's Service Department for assistance.

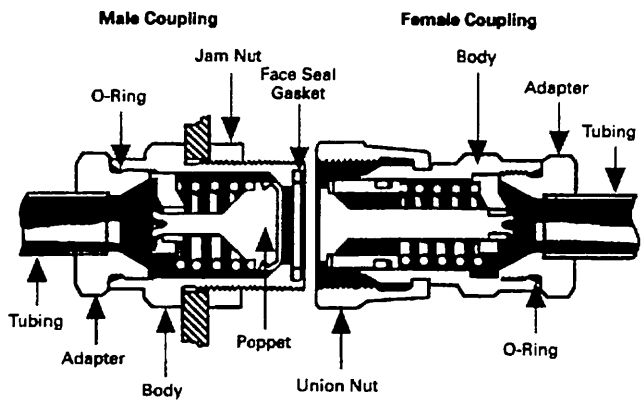
4.2.1 CONNECTING GAS FLEX LINES

1. The system gas connections are shipped with caps and plugs to keep the fittings clean and free from damage. Remove the caps and plugs and thread them together for storage. Whenever any component of the system is disconnected, put the caps back on to prevent entry of dust or damage to threads.
2. Wipe the faces of the couplings with a lint-free cloth to ensure that they are clean and free of any contaminants.
3. Ensure that the face seal gasket is in place on the inside of the casing of the male coupling. (Figure 4.1)
4. To make the connection, start turning the female hose side union nut onto the male connector by hand. Then, with the appropriate wrenches (as shown in the Accessory Kit), hold the stationary part of the female coupling while turning the union nut with the other wrench. Use a small amount of pure isopropyl alcohol as a lubricant on both mating pieces while making the connection. See Figure 4.2. As the poppet begins to open, there may be a slight venting of gas from the fitting. Continue to tighten until the female coupling is firmly seated against the face seal on the male coupling.

WARNING!

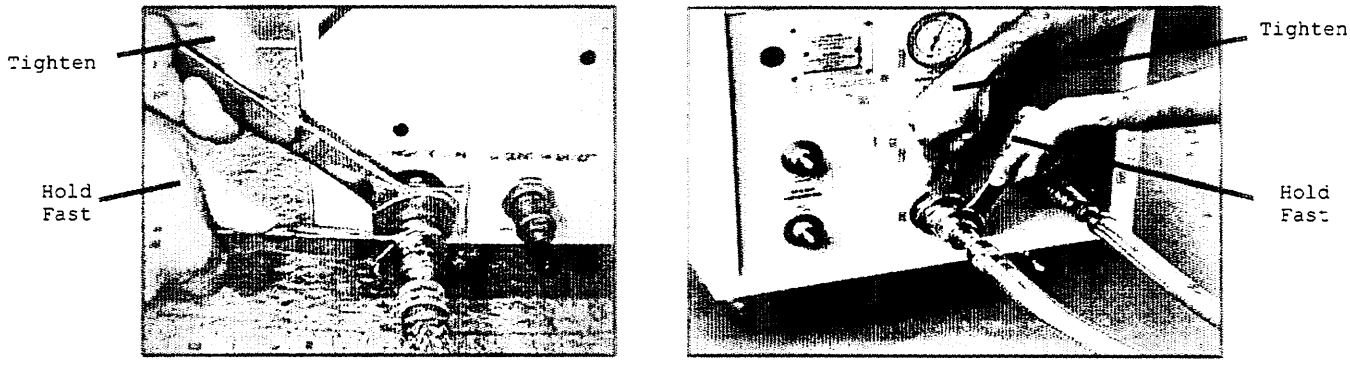
ALWAYS CONNECT ONE FLEXLINE FROM THE SUPPLY SIDE ON THE COLD HEAD TO THE SUPPLY SIDE ON THE COMPRESSOR. ALWAYS CONNECT THE OTHER FLEXLINE FROM THE RETURN SIDE ON THE COLD HEAD TO THE RETURN SIDE ON THE COMPRESSOR. CROSSED LINES WILL DAMAGE THE COLD HEAD.

FIGURE 4.1 COUPLINGS, MALE, FEMALE



The required torques are:

35 ft-lbs (47.5 N-m) for the 1/2" connection (#8 Aeroquip).
45 ft-lbs (61.0 N-m) for the 3/4" connection (#12 Aeroquip).



Flexline connection to 6200 MD compressor

Flexline connection to UCC 110S compressor

FIGURE 4.2 PROPER CONNECTIONS OF AEROQUIP COUPLINGS

WARNING!

WHEN CONNECTING OR DISCONNECTING THE SELF-SEALING COUPLINGS FOR THE GAS FLEXLINES, ALWAYS USE TWO WRENCHES AS SHOWN IN FIGURE 4.2

4.2.2 DISCONNECTING THE GAS FLEXLINES

4.2.2.1 Disconnecting the gas flexline at the Cold Head:

1. Use one wrench to turn the female coupling union nut (the female coupling is always connected to the gas flexline) about 1/8 turn, while holding the male coupling with the other wrench. This will overcome the initial torque required to break the connection without loosening the male connector from its adapter. Ensure that the hose is free to rotate, so as to avoid torsional force on the hose. Use a small amount of pure isopropyl alcohol as a lubricant when making the disconnections.

2. Place the second wrench on the stationary part of the female coupling and continue to unthread the union nut. Be sure the male connector does not rotate when disconnecting.

4.2.2.2 Disconnecting the gas flexline at the Compressor:

1. Turn the union nut on the female coupling while holding the stationary part of the female coupling with a second wrench. Since the male coupling is bulkheaded to the compressor front panel with a lock washer, the male coupling should not rotate from its adapter while being removed. However, ensure that the bulkhead jam nut is secure and that the male coupling does not rotate when removing the gas line.

2. When the hoses are disconnected check each male coupling to ensure the face seal is in place. Occasionally, if the hose is venting during disconnection, the face seal will be blown out of its gland and into the female coupling. Failure to remove the seal from the female coupling will cause the connection to leak when reconnected, with or without another face seal installed. If all seals are in place, as they should be when the lines are disconnected, replace the dust caps and plugs.

Notes: 1. Ensure the male coupling at the compressor and cold head do not rotate when disconnecting lines.
2. Avoid torsional forces on the flex lines.

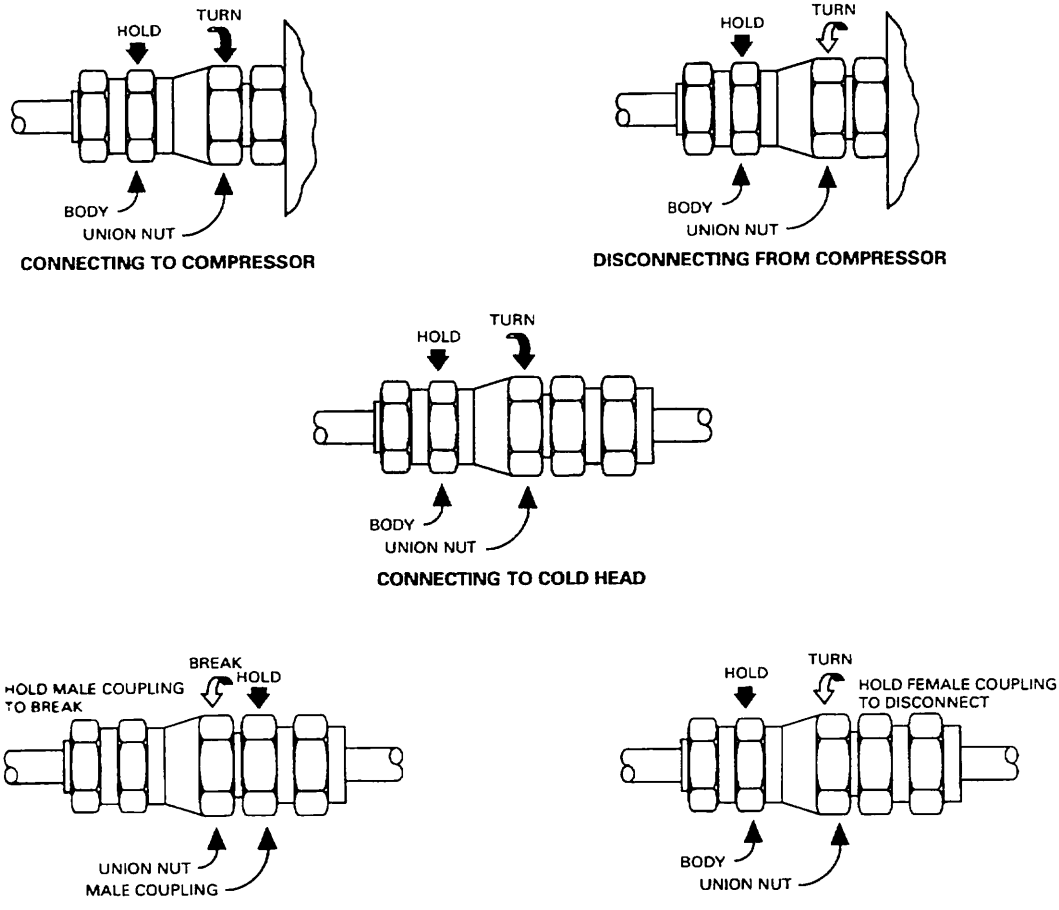


FIGURE 4.3 CONNECTING AND DISCONNECTING GAS FLEX LINES

4.3 ELECTRICAL CONNECTION

The electrical power source for the refrigerator drive motor is located in the compressor.

Install the interconnecting cable between the electrical connector on the front panel of the compressor marked 'Cold Head' and to the electrical connector on the rear of the motor housing on the cold head.

5.0 OPERATION

5.1 STARTING OPERATION

APPLY POWER TO THE COMPRESSOR UNIT ONLY AFTER ALL COOLING SYSTEM, ELECTRICAL AND WATER CONNECTIONS HAVE BEEN PROPERLY MADE. (SEE COMPRESSOR MANUAL).

FOR SYSTEMS USING THE 6000 MD OR 6200 MD COMPRESSOR:

Three buttons located on the compressor's front panel activate the system when it is operating in manual mode.

On: This button, located between the "off" and "select" buttons, supplies power to the compressor and cold head after a few seconds delay. The start delay protects the compressor unit from being restarted immediately after being shut down.

Select: This button allows scrolling through the display of options on the front panel. Refer to the compressor manual for specific settings.

Off: This button shuts off the compressor and cold head. Refer to the compressor manual for specifics.

FOR SYSTEMS USING THE UCC 110S COMPRESSOR:

Three switches located on the compressor front panel activate the system when it is operating in manual mode.

Main Power: The rocker switch, which is located on the right when facing the compressor, supplies power to the control circuit.

Compressor Power: The rocker switch, which is located in the center of the unit,

closes the control circuit and starts the compressor.

Cold Head Power: The switch, located on the left side, closes the cold head circuit. The cold head will operate when all three switches are in the ON (Up) position. For remote operation, refer to the Compressor Manual.

5.2 COOL DOWN OPERATION

The length of time required to cool down to ultimate bottom temperatures will vary with the load applied to the refrigerator.

The refrigerator should not be turned on until the surrounding insulating vacuum pressure is 5×10^{-2} mbar or below.

When the Leybold Cryogenic Refrigerator is used as the cooling device in a cryogenic pump, the cool down time of the pump will vary depending on the mass of the panels and the total heat load to the System.

6.0 MAINTENANCE

This maintenance section only covers procedures which can be performed without breaking into the system's gas boundaries. In the case of the cold head, this precludes all maintenance procedures except for decontamination.

6.1 DECONTAMINATION

It is critical that the helium in the system be pure because contamination can severely impair the operation of the system. In a mild case, it will cause loss of refrigeration capacity and in an extreme case, contamination will cause a mechanical failure.

HELIUM CERTIFIED AT 99.999% PURITY OR BETTER MUST BE USED TO PREVENT CONTAMINATION OF THE COLD HEAD.

First indications of helium contamination is a loss of cooling.

Contaminants can also freeze out in the cold head and hinder its mechanical operation. Significant contamination can cause ratcheting (refrigerator running intermittently with an accompanying mechanical knocking) or complete seizing of the cold head drive mechanism.

Corrective steps should be taken at the first sign of contamination.

Typically there are three types of contaminants: air, water, oil. Air and water can enter the system by back diffusion of atmospheric air through a leak, by recharging the system with an improperly purged gas line, or by recharging the system with impure helium.

Water and oil vapors can evolve gradually in the system by operating the compressor at abnormally high temperatures. Surface water in equilibrium at normal temperatures will outgas at elevated temperatures. High operating temperatures will not only increase the amount of oil entrained in the compressed gas, but will also reduce the efficiency of the oil separation system, thereby causing the separation system to fail prematurely.

Oil can be introduced into the gas stream by using an adsorber beyond its rated life of operation (26,000 hours).

Except for a gas analysis, it is not possible to determine the type of contamination.

The following procedure will remove air and water contamination; however, no gas clean-up procedure will eliminate oil contamination. At best, any improvement will only be temporary. In mild cases, decontamination can be performed at the cold head alone.

In more severe cases, however, it is best to decontaminate both the cold head and compressor. **If the cold head will not cool down at all, proceed directly to the following:**

READ THESE INSTRUCTIONS COMPLETELY BEFORE BEGINNING THIS PROCEDURE, THEN FOLLOW THE PROCEDURE STEP BY STEP

Equipment needed for this procedure:

Cold head bleed adapter
Cold head charge adapter
Aeroquip wrench set.

High pressure helium cylinder, including proper charging line and regulator.

REPAIR SERVICE OF ANY COMPONENT MUST BE PERFORMED BY TRAINED AND QUALIFIED PERSONNEL.

PROCEDURE:

1. If possible, operate the system until the cold head achieves its normal bottom temperature.
2. After the cold head has reached its lowest operating temperature and while still running, disconnect the high pressure supply line (the line with the smaller Aeroquip connector) at the cold head. Allow the cold head to continue to operate for two minutes, with the low pressure line attached.
3. With the cold head still running, disconnect the low pressure line from the cold head, and then turn the cold head and compressor off. Leave the pressure lines connected to the compressor.
4. Allow the cold head to warm to room temperature.
5. When the cold head is at room temperature, connect an Aeroquip (self-sealing) bleed adapter to the return aeroquip fitting on the cold head, and allow the helium inside the cold head to slowly bleed down to atmospheric pressure.

ADEQUATE VENTILATION MUST ALWAYS BE PROVIDED WHEN VENTING, PURGING OR CHARGING ANY COMPONENT OF THE SYSTEM.

6. Attach a high pressure helium cylinder, using a proper adapter, charging line and regulator to the cold head high pressure fitting.
7. Adjust the pressure regulator to 150 psig (1034 kPa).
8. Start the compressor to power the cold head motor, but do not reattach the flexlines.
9. As the cold head operates, gas will vent out from the bleed adapter. Allow the cold head to purge in this manner for five to ten minutes.
10. Remove the bleed adapter from the return aeroquip fitting while the gas is still venting.
11. Increase the regulator pressure to 250 psig (1724 kPa).
12. Turn off the compressor.
13. Remove the charging line and adapter from the cold head supply fitting.
14. After decontaminating the cold head and compressor (see the Compressor Manual for this procedure), the system is ready to be returned to service. Reconnect the supply and return gas lines to the cold head as described in Section 4 of this manual.

7.0 TROUBLESHOOTING

This troubleshooting guide is written to help the user identify faults, their causes and corrective action. It is broken down into a number of sub-sections by symptom.

Each sub-section then lists possible causes in the left hand column and the necessary corrective action directly opposite in the right hand column. As with the maintenance section, the corrective actions are restricted from breaking into the pressure boundaries.

All appropriate safety precautions should be observed when using this guide.

Problems covered in this section:

7.1 COLD HEAD DOES NOT START

7.1.1	Cold head switch open.	Close switch located on compressor front panel.
7.1.2	Cold head motor cable not properly connected	Ensure the cable is properly connected at both the cold head and the compressor
7.1.3	Cold head fuse open.	Replace fuse.
7.1.4	Internal connections or motor windings open or shorted	Return Cold Head to Leybold for Factory Service.
7.1.5	Cold head is mechanically locked.	Return Cold Head to Leybold for Factory Service.
7.1.6	Cold head power supply has failed.	Replace the power supply.

7.2 COLD HEAD STARTS BUT SUBSEQUENTLY SHUTS DOWN

7.2.1	Cold head shuts down but compressor continues to run	The problem is with the cold head or its electronics.
7.2.2	Cold head shuts down and compressor also shuts down.	The problem is with the compressor or main electrical power. Possibly one of the compressor interlocks, such as the thermal temperature switch, is no longer closed due to a high temperature condition. Check power, interlocks or temp. switch.

7.3 COLD HEAD OPERATION IS ABNORMALLY NOISY

7.3.1	Gas contamination.	Depending upon the contaminant, the condition may be repaired by the gas decontamination procedure in section 6.
7.3.2	Cold head has mechanical failure.	Return Cold Head to Leybold for Factory Service.
7.3.3	Cold head power supply has failed.	Replace the power supply.

7.4 COLD HEAD LOSES REFRIGERATION CAPACITY

7.4.1	Worn cold head seals.	This is evident by a steady gradual increase in temperatures. Return Cold Head to Leybold for Factory Service.
7.4.2	Improper operating pressures.	See Compressor Manual

8.0 SPARE PARTS

For 4.2GM, 445, 130 and 150 COLDHEADS

When ordering spare parts please be sure to state the model number and serial number of the cold head as shown on the name plate.

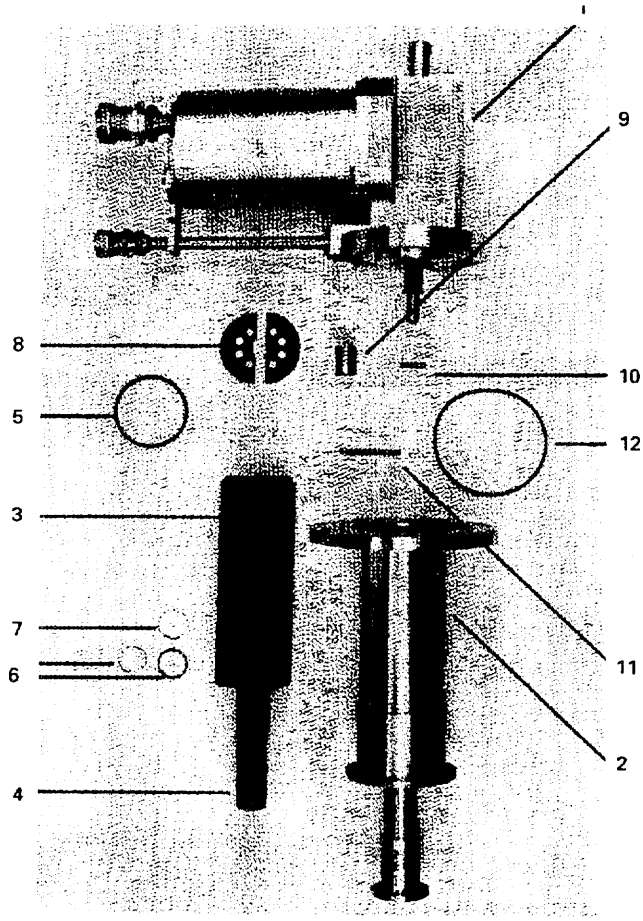


FIGURE 8.1 CRYOGENIC HELIUM REFRIGERATOR (4.2GM, 445, 130 and 150)

ITEM	DESCRIPTION
1	Drive Unit Assembly
2	Cylinder Assembly
3	1st Stage Displacer Assembly
4	2nd Stage Displacer Assembly
5	1st Stage Seal
6	2nd Stage Seal Assembly (2 Pieces)
7	2nd Stage Seal Retainer (For Older Models)

ITEM	DESCRIPTION
8	1st Stage Seal Retainer
9	1st Stage Connecting Link
10	Scotch Yoke Connecting Pin
11	1st Stage Connecting Pin
12	0-Ring
Not Shown	2nd Stage Connecting Link
Not Shown	2nd Stage Connecting Pin

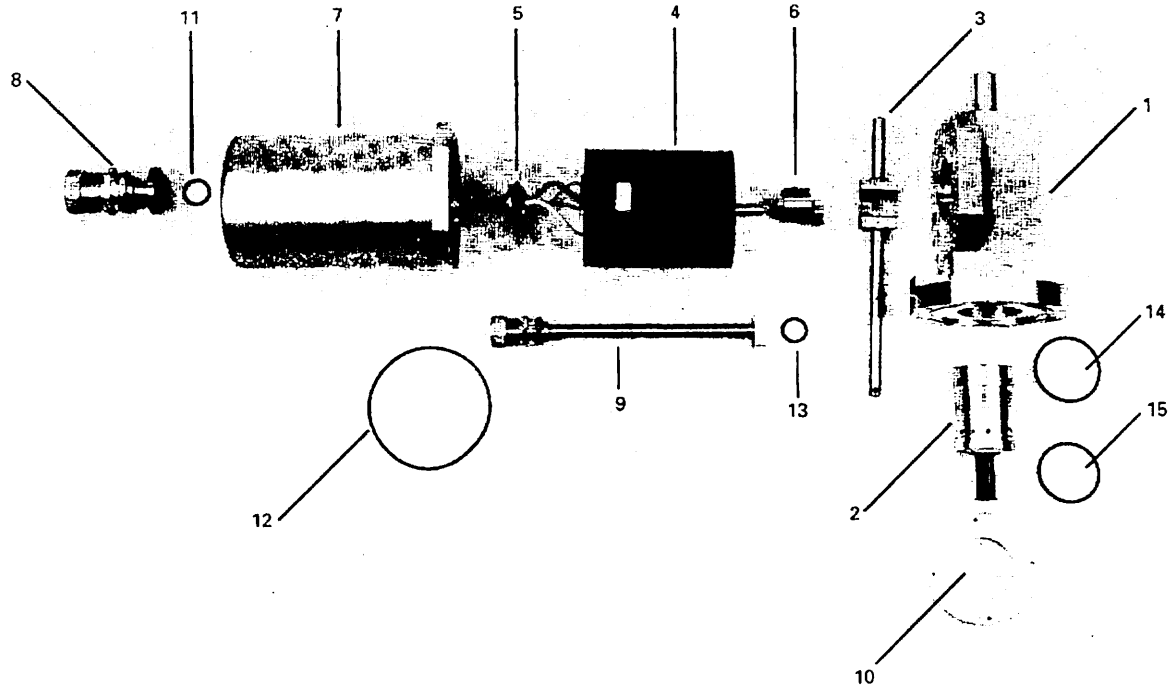


FIGURE 8.2 DRIVE UNIT ASSEMBLY (4.2GM, 445, 130 and 150)

ITEM	DESCRIPTION
1	Valve Housing Assembly
2	Valve Spool Assembly
3	Scotch Yoke
4	Motor
5	Electrical Connector Assembly
6	Crank Assembly
7	Motor Housing

ITEM	DESCRIPTION
8	Return Line Assembly
9	Supply Line Assembly
10	Valve Spool Assembly Retainer
11	O-Ring
12	O-Ring
13	O-Ring
14	O-Ring
15	O-Ring

For 065 COLDHEADS

When ordering spare parts please be sure to state the model number and serial number of the cold head as shown on the name plate.

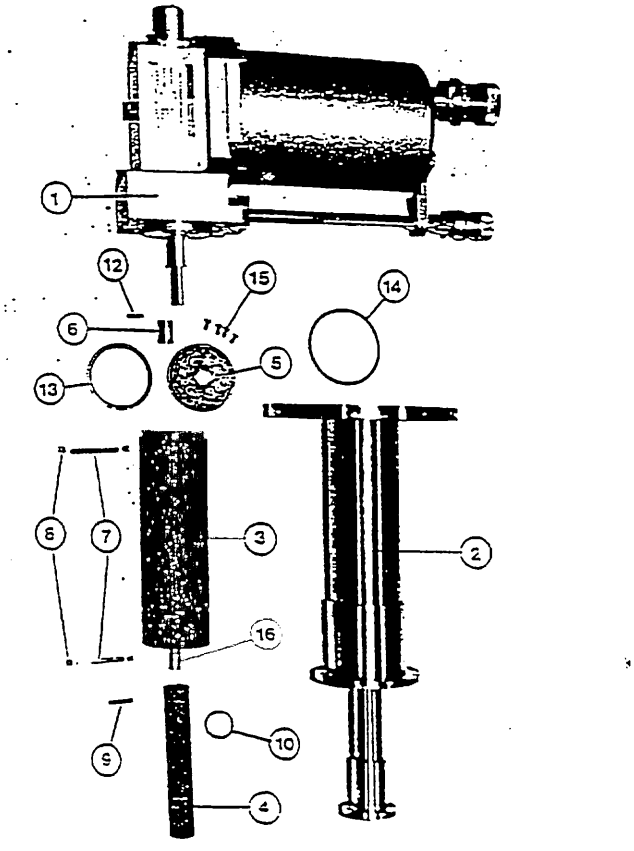


FIGURE 8.3 CRYOGENIC HELIUM REFRIGERATOR (065)

ITEM	DESCRIPTION
1	Drive Unit Assembly
2	Cylinder Assembly
3	1st Stage Displacer Assembly
4	2nd Stage Displacer Assembly
5	Upper Seal Retainer
6	Connecting Link, 1st Stage
7	Pin
8	Screw, Socket Set

ITEM	DESCRIPTION
9	Pin
10	2nd Stage Seal Assembly
11	Seal Retainer (Not shown)
12	Pin
13	Seal, 1st Stage
14	O-ring
15	Screw, Flat Head Socket
16	Connecting Link, 2nd Stage

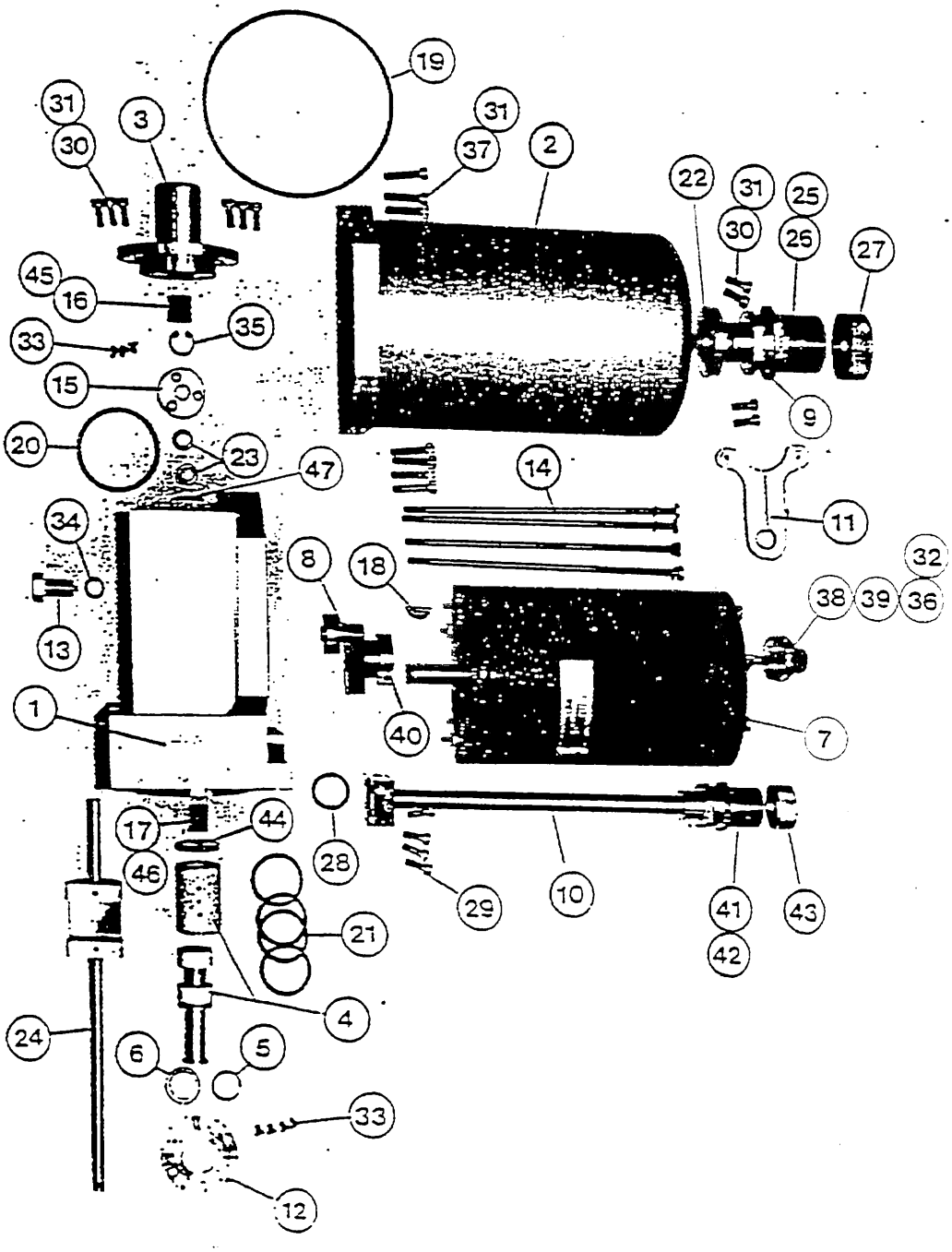


FIGURE 8.4 DRIVE UNIT ASSEMBLY (065)

PARTS LIST FOR THE DRIVE UNIT ASSEMBLY (065)

ITEM	DESCRIPTION
1	Valve Housing
2	Motor Housing
3	End Cap
4	Slide Valve Assembly
5	Spring
6	Friction ring
7	Sigma Motor
8	Crank Assembly
9	RETURN LINE WELDMENT
10	High Pressure Line Assembly
11	Support Bracket
12	Valve Retainer
13	Retainer & Guide Pin Assembly
14	Motor Tie Rod
15	Seal Retainer
16	Upper Bearing
17	Lower Bearing
18	Key, Woodruff 404
19	O-ring
20	O-ring
21	O-ring
22	O-ring
23	Shaft Seals

ITEM	DESCRIPTION
24	Scotch Yoke
25	O-RING
26	Coupling Half
27	Dust Cap
28	O-ring
29	Screw, Socket Head
30	Screw, Socket Head
31	Washer, Split Lock
32	Nut
33	Screw, Flat head Socket
34	O-ring
35	Snap ring
36	Washer
37	Screw, Socket Head
38	Connector
39	O-ring
40	Gear Clamp
41	Coupling Half
42	O-ring
43	Dust Cap
44	Retainer, Bearing
45	Sleeve Bearing
46	Sleeve, Bearing

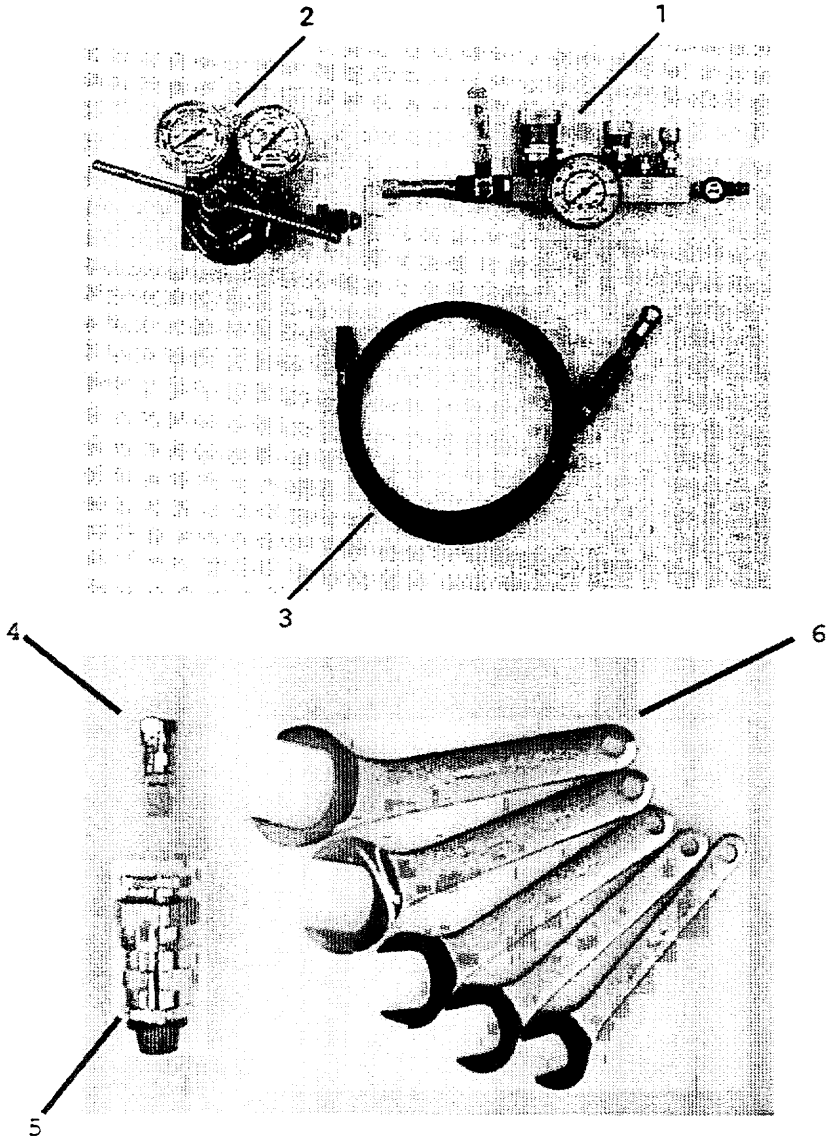


FIGURE 8.6 AVAILABLE MAINTENANCE TOOLS

1 Helium Charge/Purge Adapter - Part No. 014 010 -U
2 Helium Regulator - Obtain locally from your helium gas supplier
3 Helium Charge Line - Part No. 014 025 –U
4 Purge Adaptor for Compressor #4FX37FLR - Part No. 010 941 -X
5 Purge Adaptor for Coldhead #12FX37FLR - Part No. 014 133 -U
6 Wrench Kit - Part No. 014 006 -T

9.0 Product Specifications By Model

9.1 Coolpower 4.2GM Specifications

Part No.	011 864 -T
Refrigeration Capacity @ 60 Hz: First Stage: Second Stage:	Measured simultaneously 45W @ 50K Max. .5 W @ 4.2K Max.
Minimum Temperature Second Stage, Shielded:	3.7 K (No Load)
Electrical Requirements:	DC Motor controller supplied with compressor
Weight:	31 lbs. (14kg)
Installation Interface:	Orient Cold Head down for full regeneration performance
Recommended Maintenance Cold Head Seals Replacement:	9000 hours
Operates with Compressor:	6000 MD (PN89242), 6200 MD (PN89243) or UCC 110S (60 Hz Only)

9.2 Coolpower 445 Specifications

Part Number	011 826 -T
Refrigeration Capacity @ 60 Hz: First Stage: Second Stage:	Measured simultaneously 45W @ 45K Max. 7W @ 10K Max.
Minimum Temperature Second Stage:	6K (No Load)
Electrical Requirements:	DC Motor controller supplied with Compressor
Weight:	31 lbs (14kg)
Recommended Maintenance Cold Head Seals Replacement:	9000 hours
Operates with compressor:	6000 MD (PN89242), 6200 MD (PN89243) or UCC 110S (60 Hz Only)

9.3 Coolpower 130 Specifications

Part No.	011 702 -T
Refrigeration Capacity @ 60 Hz: First Stage: Second Stage:	Measured simultaneously, shielded 115W @ 77K Max. 15W @ 20K Max.
Minimum temperature Second Stage, Shielded:	9K (No Load)
Electrical Requirements:	DC motor controller supplied with compressor
Weight:	31 lbs. (14 kg)
Recommended Maintenance Cold Head Seals Replacement:	9,000 hours
Operates With Compressor:	6000 MD (PN89242), 6200 MD (PN89243) or UCC 110S (60 Hz Only)

9.4 Coolpower 065 Specifications

Part Number	011 085 -T
Refrigeration Capacity @ 60 Hz: First Stage: Second Stage:	Measured simultaneously 65W @ 77K Max,, Unshielded 6W @ 20K Max., Unshielded
Minimum Temperature Second Stage:	13K (No Load)
Electrical Requirements:	120V, 50/60 Hz / 1Ø, with RC Network, supplied with compressor
Weight:	31 lbs (14kg)
Recommended Maintenance Cold Head Seals Replacement:	9000 hrs.
Operates with compressor:	6000 MD (PN89242), 6200 MD (PN89243) or UCC 066S

9.5 Coolpower 150 Specifications

Part Number	011 704 -T
Refrigeration Capacity @ 60 Hz Single Stage:	150W @ 77K Max., Unshielded
Minimum Temperature:	28K (No Load)
Electrical Requirements:	DC Motor Controller supplied with compressor
Weight:	29 lbs (13kg)
Recommended Maintenance Cold Head Seals Replacement:	9000 hrs.
Operates with compressor:	6000 MD (PN89242), 6200 MD (PN89243) or UCC 110S (60 Hz Only)

LEYBOLD VACUUM USA, Inc.
Cryogenics North America
18 Celina Avenue, Nashua, N.H. 03063
Phone: 603-595-2400, Fax: 603-595-6969

Dear Valued Customers:

From time to time it may be necessary to return Balzers/Leybold equipment for repair or replacement, either during warranty or after the warranty has expired.

In order to reduce the risk of injury to personnel, any equipment being returned to LCNA must include a tag that states:

1 **The types of gases, chemicals, biological materials exposed, or other potentially harmful materials exposed to the equipment during it's use, and**

2 **Whether or not the materials are known to be corrosive, toxic, explosive, or biologically hazardous, and**

3 **The Name, Title, Department and telephone number of the person to be contacted with questions regarding the use of the equipment and the materials it has been exposed to.**

4 **Products exposed to Radioactive materials can not be accepted by LCNA under any circumstances.**

Leybold reserves the right to return, at the buyers expense, any product that is untagged, improperly tagged, unrepairable, or beyond Leybold's cleaning and decontamination abilities.

When returning products, please cover all flanges and electrical connectors with the original protective cover or any equivalent cover to ensure proper handling. This will minimize the risk of excessive damage and reduce the chance of exposure to any possible hazardous gasses to personnel working with the returned product.

We are sure that you share our concern for people's safety and request your full cooperation in carrying out these few steps prior to returning pumps to LCNA.

Thank you in advance,

Sincerely,
LCNA Safety Committee

LEYBOLD VACUUM USA, Inc.
Cryogenics North America
18 Celina Avenue, Nashua, N.H. 03063
Phone: 603-595-2400, Fax: 603-595-6969

CUSTOMER SERVICE CONTAMINATION DATA FACT SHEET

To: _____ Fax. No.: _____ From: _____ Date: _____

Please complete the following contamination data and return this with your pump or Fax it to the Fax number above. As soon as we receive this information, we will forward your equipment to our repair department.

RMA#: _____ Pump Type: _____ P/N: _____ Ser. No.: _____

Please describe the application of the pump being returned: _____

_____

_____

Known material in contact with the product are:

Potentially Hazardous: _____ Toxic: _____ Unknown: _____
Non-Hazardous: _____ Explosive: _____
Biologically Hazardous: _____ Corrosive: _____

List all types of gases and chemicals (common names, specific chemical) exposed to the product during it's use. Attach separate sheet if needed. _____

_____

_____

PRODUCTS EXPOSED TO RADIOACTIVE MATERIAL CAN NOT BE ACCEPTED BY LEYBOLD UNDER ANY CIRCUMSTANCES.

Contact Name and phone number for questions regarding the use of the pump and material in contact with it.

Name: _____ **Preparer's Printed Name:** _____

Phone No.: (____)_____ **Preparer's Signature:** _____

Leybold reserves the right to return, at the buyers expense any product that is untagged, improperly tagged, unrepairable, or beyond Leybold's cleaning and decontamination abilities.

IF YOU SHOULD HAVE ANY QUESTIONS, PLEASE CALL 603-595-2400

WE CAN NOT ACCEPT YOUR PUMP WITHOUT THIS INFORMATION